

## TRENCHING AND SHORING REMINDER LIST

### I. WHERE TO FIND TRENCHING SHORING INFORMATION

Standard Specifications

5-1.02 Plans & Working Drawings

5-1.02a Trench Excavation Safety Plans

7-1.01E Trench Safety

19-3.03 Cofferdams

Cal OSHA Excavation & Trench SAFETY ORDERS

Contract Plans - Log Of Test Borings

Contract Special Provisions

Materials Reports - Geotechnical Report For Foundation Work

Trenching & Shoring Manual, Office Of Structure

Construction

USS Steel Sheet Piling Design Manual (July 1994)

Bridge Construction Records and Procedures Manual

Vol 1 8-0.0 Railroads & Related Facilities

Vol 2 145-10.0 Submitting Shoring Plans

Office Of Structure Construction

Trenching & Shoring Engineer

John Babcock @ (916) 227-8835

Other experienced Structure Representatives

Your immediate supervisor

Office Of Structural Foundations - Geotechnical Support

### II. INITIAL REVIEW CRITERIA

Deficiencies relative to this section of the check list could cause delays in starting the 'design review' clock.

1. Drawings are to be sufficiently complete to permit review.
2. Complete set of calculations required if not in accordance with Cal OSHA Standards.
3. All sheets of the excavation plan Submittal, if not in accordance with Cal-OSHA Standards, are to be stamped and signed by a Registered California Civil Engineer.
4. Soil classification and other related information provided ( $\phi$ ,  $\delta$ ,  $\gamma$ ,  $k_p$  &  $k_a$  or  $k_v$ ).
5. Method and sequence of shoring installation and excavation specified, including temporary bracing.
6. All controlling design dimensions must be shown (H, D,  $H_s$ , L, etc.).
7. Sufficient detail and supporting data is included to permit a complete stress analysis, including duration of excavation and start time.
8. Verify constructability at location specified. Will the shoring plan infringe upon existing facilities or utilities.
9. Manufacturer's brochure and engineering data submitted if appropriate.

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### III. DESIGN REVIEW REQUIREMENTS

1. Monitor review time
  - 3 weeks for engineered trenches<sup>1</sup>.
  - 5 days for trenches in accordance with Cal-OSHA Standards<sup>1</sup>.
  - 3 weeks for cofferdams<sup>2</sup>.
  - review Special Provisions for project specific requirements.
  - 12 weeks for locations requiring plan review by a railroad<sup>2</sup>.
2. Maintain a correspondence log for each shoring plan submitted Include entries for stopping and starting the design review time.
3. Verify all surcharges are considered (railroad, traffic, K-rail, existing facilities, etc). Use a minimum 72 psf (3510 N/m<sup>2</sup>) surcharge. SPTC (Southern Pacific Transportation Company) requires use of the Boussinesq pressure distribution to determine Lateral pressure on shoring.
4. Determine the effect of construction sequencing and activities on the excavation.
5. Review the contractor's submittal for confined space requirements in accordance with Cal-OSHA requirements.
6. Verify contractor has accounted for water in the design if it is present, or has specified dewatering.
7. Manufactured assemblies shall be used and installed in accordance with the manufacturer's recommendation and certification shall be furnished by the Contractor.

### IV. STRUCTURAL REVIEW

1. Steel - refer to current AISC specifications. If grade of steel is unknown use A36 ( $F_y=36$  ksi,  $E=30 \times 10^6$ ) or A36M ( $F_y = 250$  MPa,  $E=20.7 \times 10^4$  MPa)
2. Welding - refer to current AWS design requirements.
3. Aluminum - refer to current aluminum design requirements.
4. Concrete - refer to current structural concrete design requirements.

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<sup>1</sup> Standard Specifications Section 5-1.02A, Trench Excavation Safety Plans

<sup>2</sup> Standard Specifications Section 19-3.03, Cofferdams

<sup>3</sup> Refer to Trenching and Shoring Manual Memo 3

<sup>4</sup> Refer to Trenching and Shoring Manual Section 12

## APPENDIX H

### 5. Timber

- Construction Safety Orders define lumber and allowable stresses in Appendix C to section 1541.1
- shoring plans designed by a qualified Engineer which do not specify stress limitations or list type of lumber may be assumed to be Douglas Fir Larch (North) Group II with the following stress limitations:
  - $F_c = 480,000 / (L/D)^2$  psi     $(3310 / (L/d))^2$  MPa
  - $F_b = 1,500$  psi    (10.3 MPa)
  - $F_t = 1,200$  psi    (8.3 MPa)
  - $F_a = 450$  psi    (3.1 MPa)

6. Short term increase to allowable stresses are allowed (to maximum of 133%) except in the following situations:
- a. excavations in place more than 90 days
  - b. when dynamic loadings are present( pile driving, traffic, etc)
  - c. when excavations are adjacent to railroads
  - d. all horizontal struts

## V . EXCAVATIONS ADJACENT TO TRAFFIC AND EXISTING STRUCTURES

1. Review the effect of possible settlements in the roadway. Require a system to monitor changes in roadway grades if this is a concern.
2. Require temporary railing to be anchored if within 2' (0.6 m) of the excavation.
3. Additional protection provided adjacent to pedestrian walkways in accordance with Cal OSHA requirements.
4. Shoring systems adjacent to roadway should not allow material loss from behind the shoring.
5. Consider using  $K_o$  rather than  $K_a$ .
6. Ensure shoring system is rigid enough&prevent movement of the shoring. Use of prestressed tiebacks or struts jacked into place.

## VI. RAILROAD REVIEW REQUIREMENTS

1. Refer to Chapter 7, Appendix C and Memo 3 of the Trenching & Shoring Manual.
2. Project specific information may be found in Sections 10 & 13 of the Special Provisions.
3. Shoring plans adjacent to railroads are to be approved by the Railroad involved prior to approval by the Structure Representative.

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4. After structure representative's review, drawings and calculations should be forwarded for review to Sacramento. The following information should be included:
  - Name of railroad company and contract number
  - Bridge name and number, county, route, and post mile
  - Distance from centerline of track to face of excavation.
5. Contact the Railroad Agreements Section for project specific problems.

### VII. APPROVAL PROCESS

1. Engineered System - "Plan Approval" stamp on each sheet, signature and P.E. number of structure representative or staff member who has reviewed the design and is a Registered California Civil Engineer.
2. Proprietary System - "Plan Approval" stamp (blockout P.E. number line) on each sheet, signed by structure representative.
3. In accordance with Cal OSHA Standards - "Plan Approval" stamp (blockout P.E. number line) on each sheet, signed by structure representative.
4. Railroad Company involved - same as above except no approval will be given by structure representative until notified by Sacramento Office Of Structure Construction Shoring Engineer that the plan is satisfactory to the railroad company involved.
5. Contractor should be notified by phone when plan is approved, followed with an approval letter and approved set of plans.
6. Forward one copy of approved shoring plan and structure representatives calculations to Sacramento Office of Structure Construction.

## **APPENDIX H**

### **VIII. CONSTRUCTION CONSIDERATIONS (BEFORE INSTALLATION)**

1. Request APPROVED copy of shoring plan from RE/Structure Rep or Permit Engineer and verify contractor has a identical set of APPROVED plans.
2. Request notification of the contractor's competent person on job site.
3. Verify contractor has requested, and the utility mark out has been completed. Regional notification centers include but are not limited to the following:
  - Underground Service Alert
    - Northern California (USA) 1-800-642-2444
    - Southern California (USA) 1-800-422-4133
  - South Shore Utility
    - Coordinating Council (DIGS) 1-800-541-3447
  - Western Utilities Underground Alert, Inc  
1-800-424-3447
4. Overhead utilities should be signed in accordance with Cal OSHA requirements.
5. If utilities are to be relocated, verify that they are outside the limits of the contractor's proposed work area.
6. Photograph the area to be excavated.
7. Verify required work can be completed with approved shoring plan and will not affect adjacent work taking place.
8. Verify Contractor has obtained a Cal-OSHA Excavation Permit.
9. Verify that the materials required by the design are present on site.
10. Review with the contractor the allowable locations. for spoil piles.
11. Setup settlement monitoring system for excavations adjacent to existing facilities.

### **IX. CONSTRUCTION CONSIDERATIONS (DURING INSTALLATION AND EXCAVATION)**

1. If soil parameters are assumed they should be verified by the Contractor's competent person or Engineer of Record ASAP.
2. Monitor water table and verify with assumed location for design.
3. Verify contractor is following the approved construction sequence.
4. Verify size and length of members prior to installation.
5. Verify grade of materials similar to or better than that used for design.
6. Review drainage around excavation to avoid wet condition.

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7. Review adequacy of workmanship and verify that it is in accordance with the approved plans.
8. Verify safety rails and ladders are-in accordance with Cal-OSHA requirements.
9. If welds were designed using AWS allowable stresses, verify welders have current AWS certification.
10. Notify railroad and request flag person when applicable.
11. Continue settlement monitoring when excavation is adjacent to existing facilities.
12. If dewatering is required, verify that the dewatering system is in compliance with SWPPP (Storm Water Pollution Prevention Plan) requirements and discharge is less<sub>3</sub> than 100,000 gals/day ( $378.5 \times 10^3$  L/day or  $378.5 \text{ m}^3/\text{day}$ ).
13. Verify that dewatering is not causing undue settlement of surrounding facilities.

### X. CONSTRUCTION CONSIDERATIONS (SHORING IN PLACE)

1. Daily review required by contractors competent person prior to workers entering an excavation to verify\* shoring system is continuing to perform as designed and that all Cal-OSHA requirements are being followed.
2. Continue to monitor deflection of shoring and ground settlement adjacentto existing facilities (roadways, buildings, etc.) Settlement beyond that expected could be an indication of 'heave' or system failure.
3. Backfill behind beams and lagging if voids develop.
4. Verify that handrails and ladders are maintained in accordance with Cal-OSHA requirements<sup>5</sup>.
5. Record time excavation is open if short term stress increases (SO days or less) were allowed.

### XI. CONSTRUCTION CONSIDERATIONS (SHORING - AND BACKFILL)

1. Verify that the contractor is following the approved shoring removal sequence.
2. Request written notification from contractor to leave shoring in place.
3. Consider future affects of leaving temporary shoring in place.
4. For excavations within other's R/W, confirm with the property owner that the shoring material may be left in place.

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<sup>5</sup> The Cal-OSHA Construction Safety Orders should be consulted. A partial list of applicable sections are; 1541, 1621, 1629, 1675, 1676, 1677 and 1678.

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5. If timber lagging is allowed to be left in place, confirm that the lagging has been pressure treated.
6. Verify that all material is removed a minimum of 2' (610 mm) below finished grade.
7. Backfill all excavations in accordance with Section 19 of the Standard Specifications.
8. Show all temporary shoring material left in place on as-builts.
10. Record final settlement and deflection when excavation is adjacent to existing facilities and record in structure representative's daily diary.

## **XII. PROJECT SPECIFIC REQUIREMENTS**

- 1.
- 2.
- 3.
- 4.
- 5.